Kwaliteit, efficiëntie en innovatie anno 2008

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1959

Our current prosperity is based on the dramatic increases in quality and efficiency of the 20th century.


1982

2008


2008

IBIS UvA

Team

6 consultants (including one professor, one associate professor), 2 scientific advisors, and 1 office manager.

History

Established 1994.

1998: independent enterprise (b.v.) within the UvA Holding.

Revenue (2007)

1.8 mio Euro

IBIS UvA BV

INSTITUUT VOOR BEDRIJFS- EN INDUSTRIËLE STATISTIEK

IBIS UvA: clients

Manufacturing industry
General Electric Plastics
DAF Trucks (Paccar)
LG.Philips-Displays
Philips Lighting, Sensata
Perlos, Desso, NedTrain

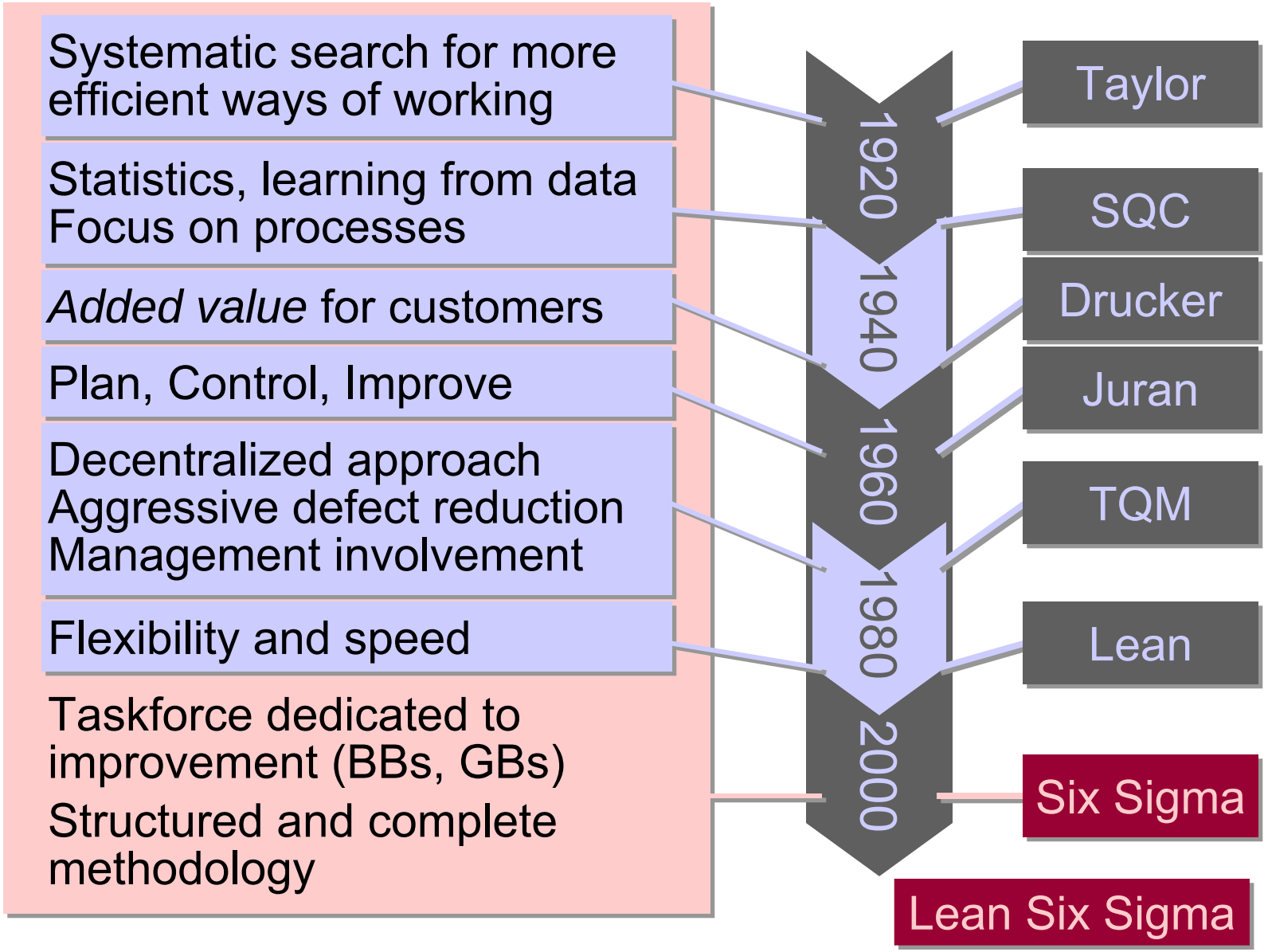
Finance and services
ABN AMRO Bank
Achmea Pensions
Getronics, Wolters Kluwer
TNT Mail Netherlands
ING Bank, Burgers Ergon

Food industry
Douwe Egberts (Sara Lee)
United Biscuits (Verkade)
Noviant
Friesland Foods

Healthcare
Red Cross Hospital
Canisius Wilhelmina Hospital
Virga Jesse Hospital
Lange Land Hospital
RdGG, EMC and UMCG

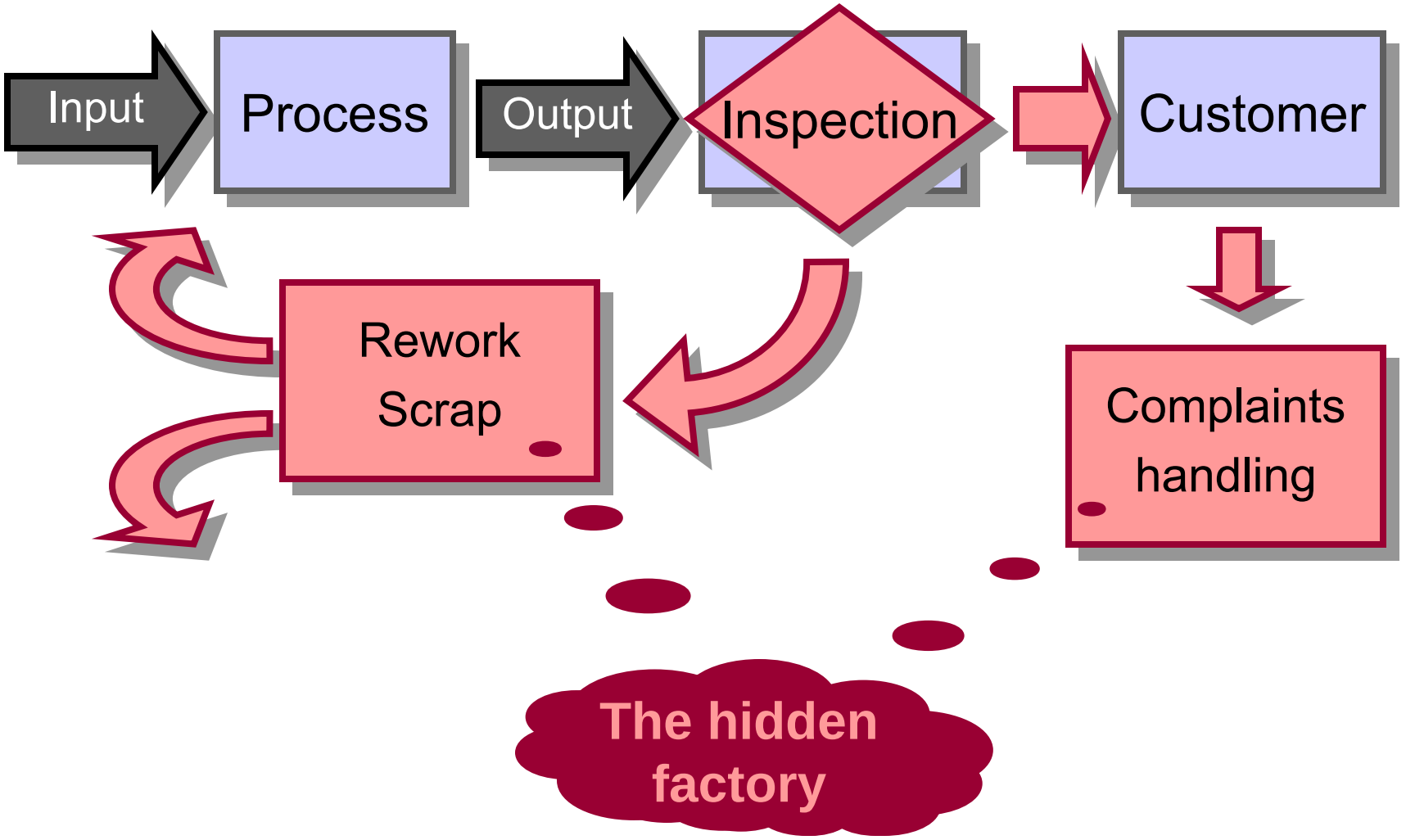
Historical roots of Lean Six Sigma

Predecessors of Lean Six Sigma



Why quality improvement?

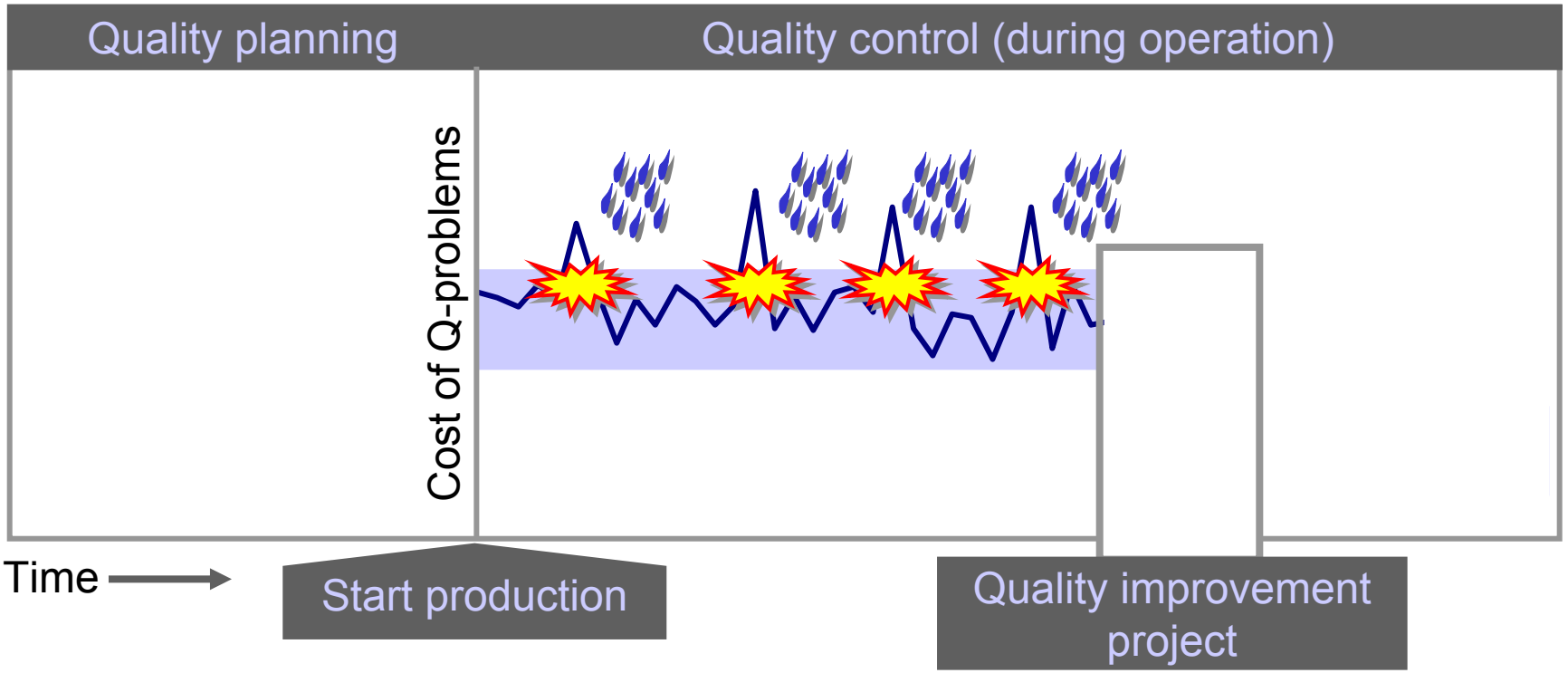
The hidden factory



Costs of poor quality

Internal failure	Costs for prevention
Waste Rework Unplanned stagnations Tackling disturbances	Training Quality planning Process control Certification of suppliers Customer service
External failure	**Costs for inspection**
Complaints handling Compensation for damage Loss of goodwill Penalties	Inspection of supplies IT costs Inspection by QA Check and recheck Audits

Juran's *quality trilogy*



Why quality improvement?

Conclusions

Current production processes are on the brink of what is technically feasible:

- Volume
- Cycle time
- Complexity of products and processes

The reactive approach of quality control no longer suffices.

Attention shifts towards: systematical attack of disturbances and problems

What is Six Sigma?

Six Sigma

… the current incarnation of business and industrial statistics.

Managerial and methodological framework for organizing systematic innovation in organizations.

- Improvement of routine functions (manufacturing processes, service delivery, sales, nursing)
- Organizational and management structures.
- Research methodology for improvement projects.
- Tools and techniques.

Electronics
Sony
Samsung
Philips

Telecom
Nokia
Ericsson
Motorola

Automotive
Ford
Paccar/DAF
Volvo

Aircraft
Bombardier
Boeing
KLM

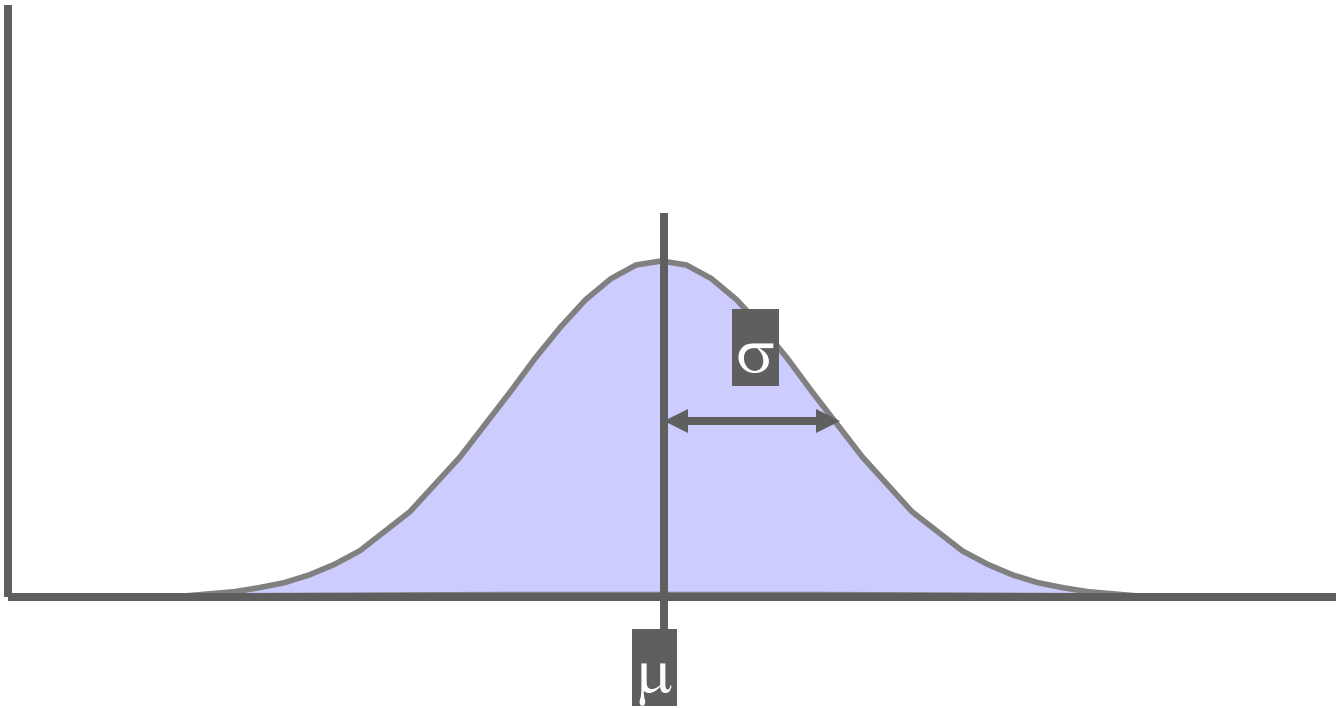
Finance
Citibank
Bank of America

Materials
GE
DuPont
Shell

Sigma = standard deviation

CTQ measurements

6.07
4.33
5.03
5.36
4.11
5.23
3.93
4.60
4.73
5.40
5.08



σ is a metric for the dispersion (standard deviation).

Six Sigma = performance objective

Sigma level	DPMO
1σ	697672
2σ	308770
3σ	66 811
4σ	6 210
5σ	233
6σ	3.4

Quality improvement requires an investment, but reduces costs.

The objective performance level should be the break-even point.

The 6σ objective symbolizes the systematical pursuit of breakthroughs.

What is Lean?

Origins

The Toyota Production System

1910 – 1970s: prevailing industrial paradigm was mass production, based on exploitation of economies of scale.

1950s: Toyota builds a lean manufacturing system:
- less rework by aggressive defect reduction
- low inventory levels by small batch sizes + efficient change-overs
- “Just-in-time” production

In the 1980s it became apparent that the Japanese manufacturing paradigm (speed and flexibility) was vastly superior to the Western mass production paradigm (volume and cost).

Lean is about eliminating waste

Lean thinking = a mindset

Becoming alert of waste, and
becoming allergic to waste.

We should call
"Just the way it's always been done"
by a new name:
"Waste"

Benefits of lean services:

- Better responsiveness (shorter lead times and cycle times);
- Higher efficiency (reduced processing times, costs and rework).

Typical improvement points in services

Administrative workers have to spend time chasing information → waste.

Multiple decision loops
→ Waiting time + setup times → waste.

Interruptions
→ Setup times → waste.

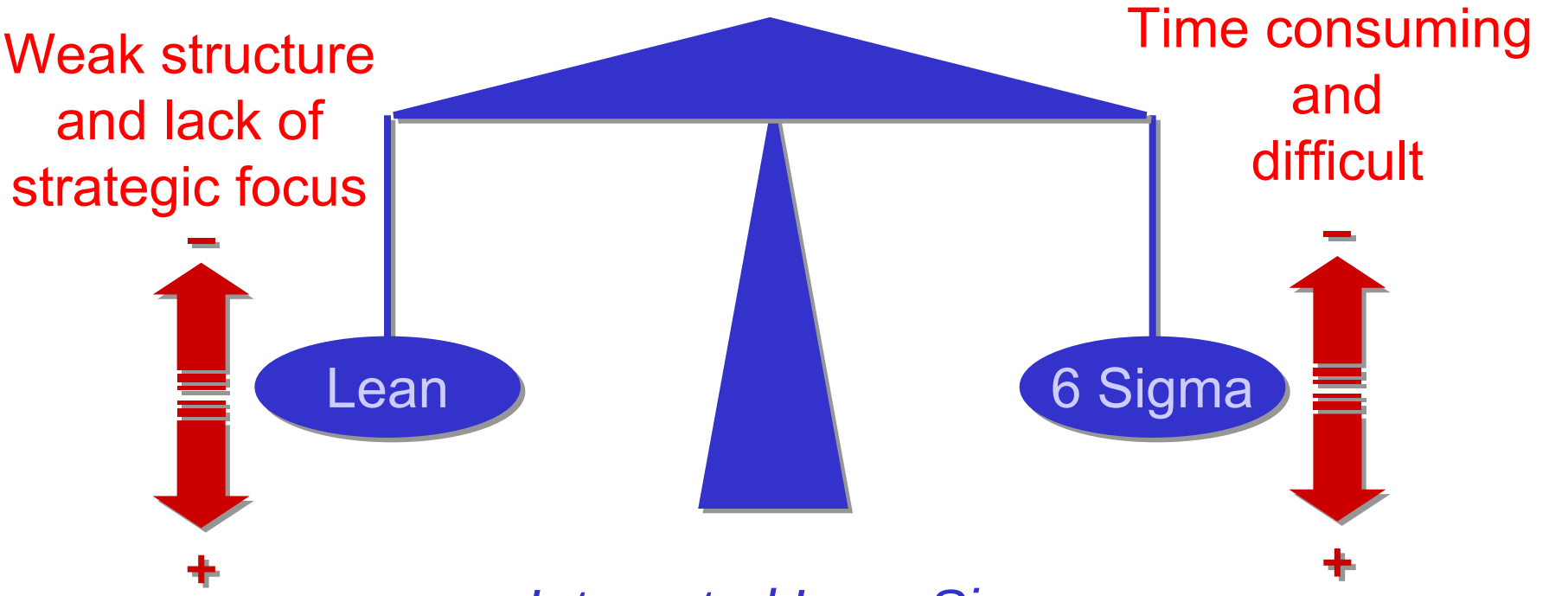
Complexity of processes and forms
→ More errors → rework → waste.
→ Long setup times → waste.

Many varieties of products / forms
→ Long setup times → waste.

Flows are invisible and therefore cannot be controlled / managed.

What is Lean Six Sigma?

Lean and Six Sigma balance



Methodology

How to carry out Improvement projects?

How to improve processes?

Core principle

Improvement actions are based:

not on gut feeling, assessments, conjectures, “experience”, authority, anecdotes, ...

but on empirical research, measurements, experiments.

Scientific method

Black belts are trained in solving problems efficiently by making use of the **scientific method**.

Scientific approach

To **control** a system
by **understanding** how the system works.

Understanding a system

To have a theory which relates the system's behaviour to the effects of influence factors.

$$Y = f(X_1, X_2, \ldots, X_n)$$

DMAIC method

Define	
Measure	1. Define the CTQ's 2. Validate the measurement procedures
Analyze	3. Diagnose the current process 4. Identify potential influence factors
Improve	5. Establish the effect of influence factors 6. Design improvement actions
Control	7. Improve process control 8. Close the project

Lean Six Sigma breakthrough cookbook

LEAN SIX SIGMA for SERVICE

Benefits

- *Improvement and redesign of routine tasks (service processes, sales, backoffice, healthcare, accounting)*
- *Resulting in superior quality and efficiency*

Strategic value

- *Superior cost structure*
- *Competitive advantages derived from customer satisfaction*
- *Competence building in manufacturing and service delivery virtuosity*

Method

- *Professional and science-like problem solving*
- *Precise and quantitative problem definition*
- *Data-based diagnosis*
- *Innovative generation of new ideas*
- *Empirical testing of ideas*

Organisation

- *Projects executed by **Black** and **Green Belts** from the line organisation.*
- *Project reviewing by **Champions** (line management and process owners)*
- *Project support by **Yellow belts** (line personnel, shopfloor)*
- *Coaching by **Master Black Belts** and programme management*

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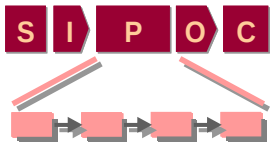
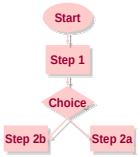
DEFINE

0. Select project



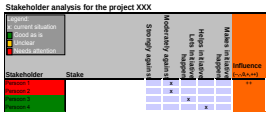
SIPOC



Flow chart

- *Process maps (SIPOC)*
- *External CTQs + stakeholders*
- *Current performance*
- *Side conditions*
- *Benefit analysis*

0. Project management

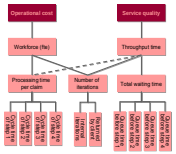


Stakeholder analysis

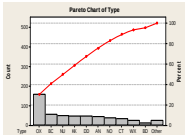
- *Project charter*
- *Stakeholder analysis*
- *Improvement team (Yellow belts)*

MEASURE

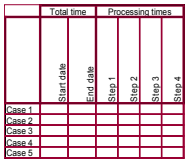
1. Define the CTQs



CTQ flowdown



Pareto analysis



Measurement plan

- *CTQ flowdown*
- *Operational definitions*
- *Measurement plan*

2. Validate the measurement procedures

$$\frac{5.15\times\sigma_{measurement}}{USL-LSL}$$

Gage R&R study

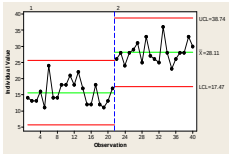
$$\kappa=\frac{P_{obs}-P_{exp}}{1-P_{exp}}$$

Agreement (Kappa) method

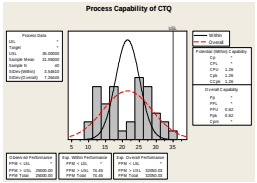
- *Validity of the measurements*
- *Systematic measurement error (bias)*
- *Random measurement error (precision).*

ANALYSE

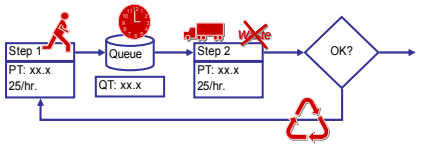
3. Diagnose the current process



Control chart



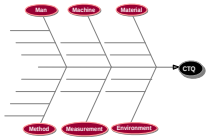
Capability analysis



Value stream map

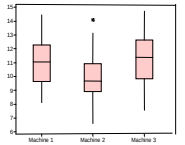
- *Process behaviour in time*
- *Process μ, σ, histogram*
- *Value stream map*
- *Updated project objectives*

4. Identify potential influence factors



Ishikawa diagram 6M

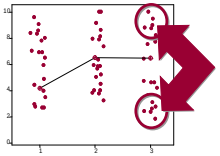
Group meetings



Exploratory data analysis

Failure mode	S	F	D	RPN
Disturbance 1	3	2	4	24
Disturbance 2	8	5	9	360

FMEA

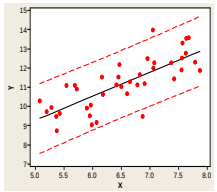


BOB vs. WOW Autopsy

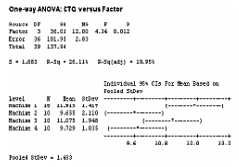
- *Control and nuisance variables*
- *Disturbances + improvement actions*
- *Process inefficiencies (waste, rework, redundancies)*
- *Process matrix*

IMPROVE

5. Establish the effect of influence factors



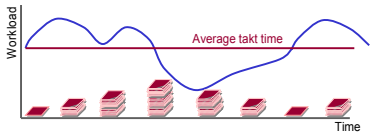
Regression analysis



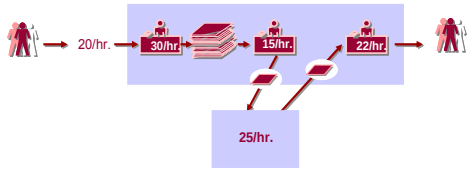
ANOVA

- *List the vital few Xs*
- *Effect of the Xs (transfer function, level averages, frequency and impact)*
- *Summary of the evidence*

6. Design improvement actions



Capacity and workload



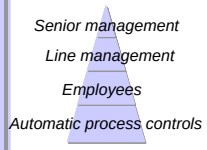
Line balancing and routing

Optimal process settings
Robustify the process
Variability reduction
Eliminate waste
Smooth workflow
Throughput time and processing time reduction

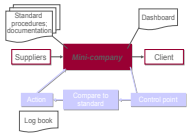
- *Should be process*
- *Settings for the control variables*

CONTROL

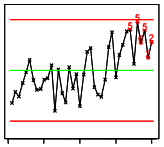
7. Improve process control



Control pyramid



The mini-company



Statistical process control

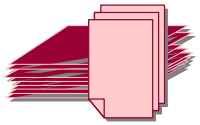
- *Roles and responsibilities*
- *Process controls*
- *Mistake prevention and proofing*

ポカヨケ

Poka yoke (mistake proofing)

8. Close the project

Benefit tracking

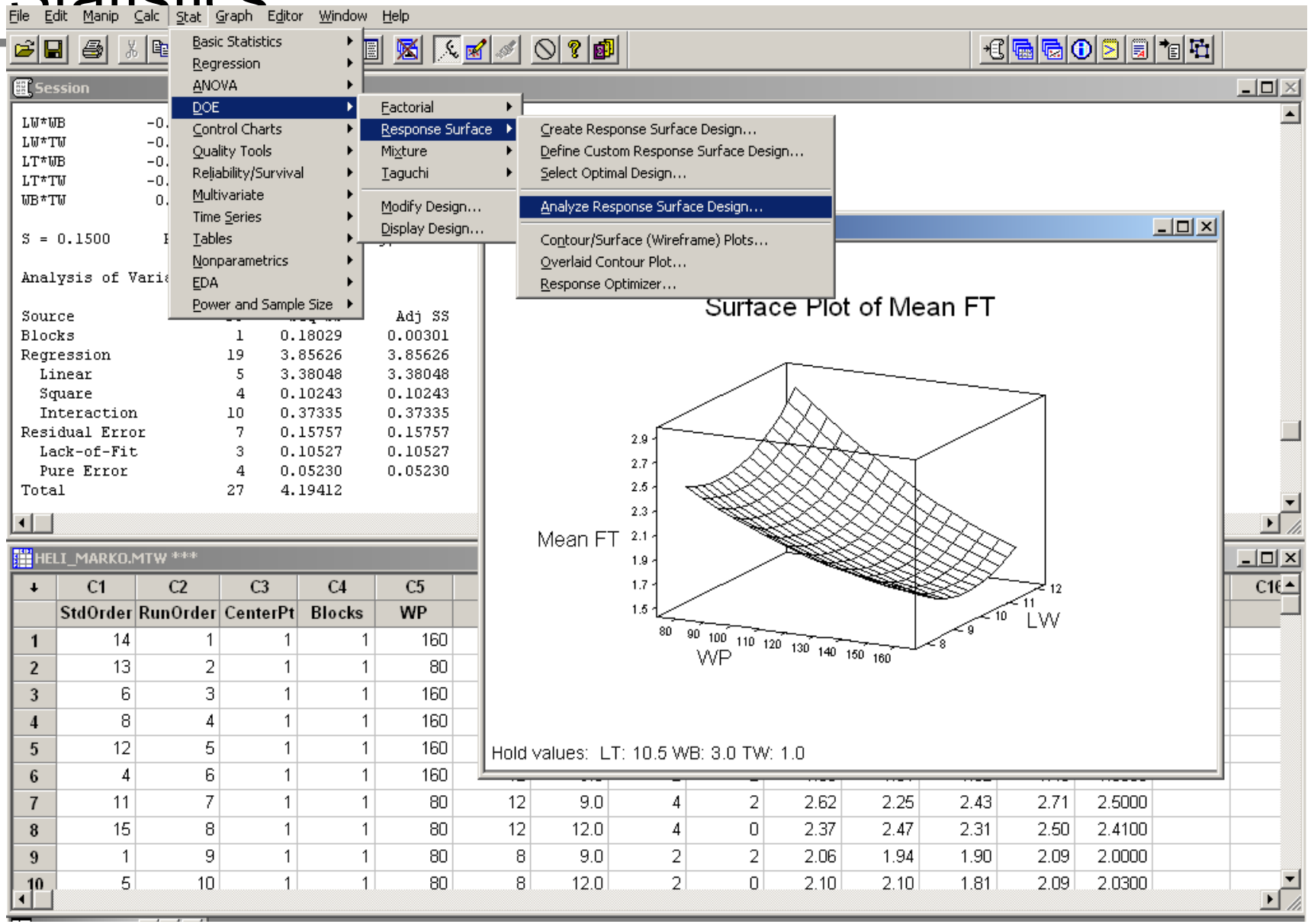


Documentation

Implementation roadmap

- *Implementation plan for pending actions*
- *Financial and other benefits*
- *Follow-ups*
- *Project documentation*
- *Benefit tracking*

Statistics



	C1	C2	C3	C4	C5									
	StdOrder	RunOrder	CenterPt	Blocks	WP									
1	14	1	1	1	160									
2	13	2	1	1	80									
3	6	3	1	1	160									
4	8	4	1	1	160									
5	12	5	1	1	160									
6	4	6	1	1	160									
7	11	7	1	1	80	12	9.0	4	2	2.62	2.25	2.43	2.71	2.5000
8	15	8	1	1	80	12	12.0	4	0	2.37	2.47	2.31	2.50	2.4100
9	1	9	1	1	80	8	9.0	2	2	2.06	1.94	1.90	2.09	2.0000
10	5	10	1	1	80	8	12.0	2	0	2.10	2.10	1.81	2.09	2.0300

Conclusions

Efficient problem solving by making use of the scientific method.

Advantages:
- Is the most efficient way to discover how a system works.
- Prevents improvement actions from being based on authority, emotion, anecdotes, ...

Lean Six Sigma implementation

1. Lean Six Sigma from a strategic perspective
2. The LSS organization
3. The project definition process
4. LSS deployment strategy

Lean Six Sigma from a strategic perspective

Investments

Lean Six Sigma organizations invest in training, time and effort. Organization-wide, BBs and GBs are trained and disengaged to work on improvement projects.

Benefits

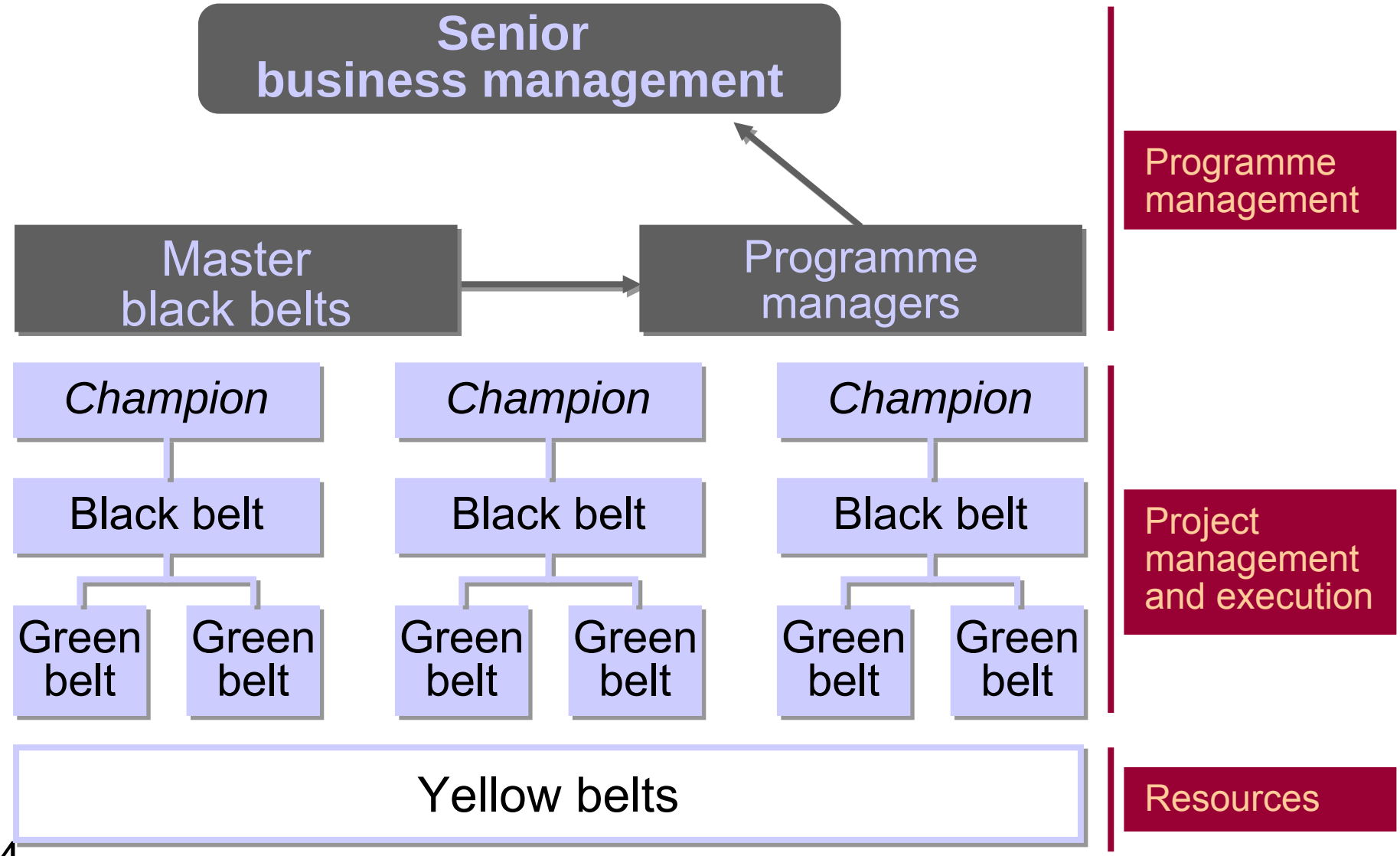
Company-wide improvement projects result in bottom-line and strategic benefits:

1. Superior cost-structure.
2. Competitive advantages derived from customer satistifaction.
3. Competence building in continous improvement, company-wide local innovation and data-based management.

Lean Six Sigma implementation

1. Lean Six Sigma from a strategic perspective
2. ***The Lean Six Sigma organization***
3. The project definition process
4. Lean Six Sigma deployment strategy

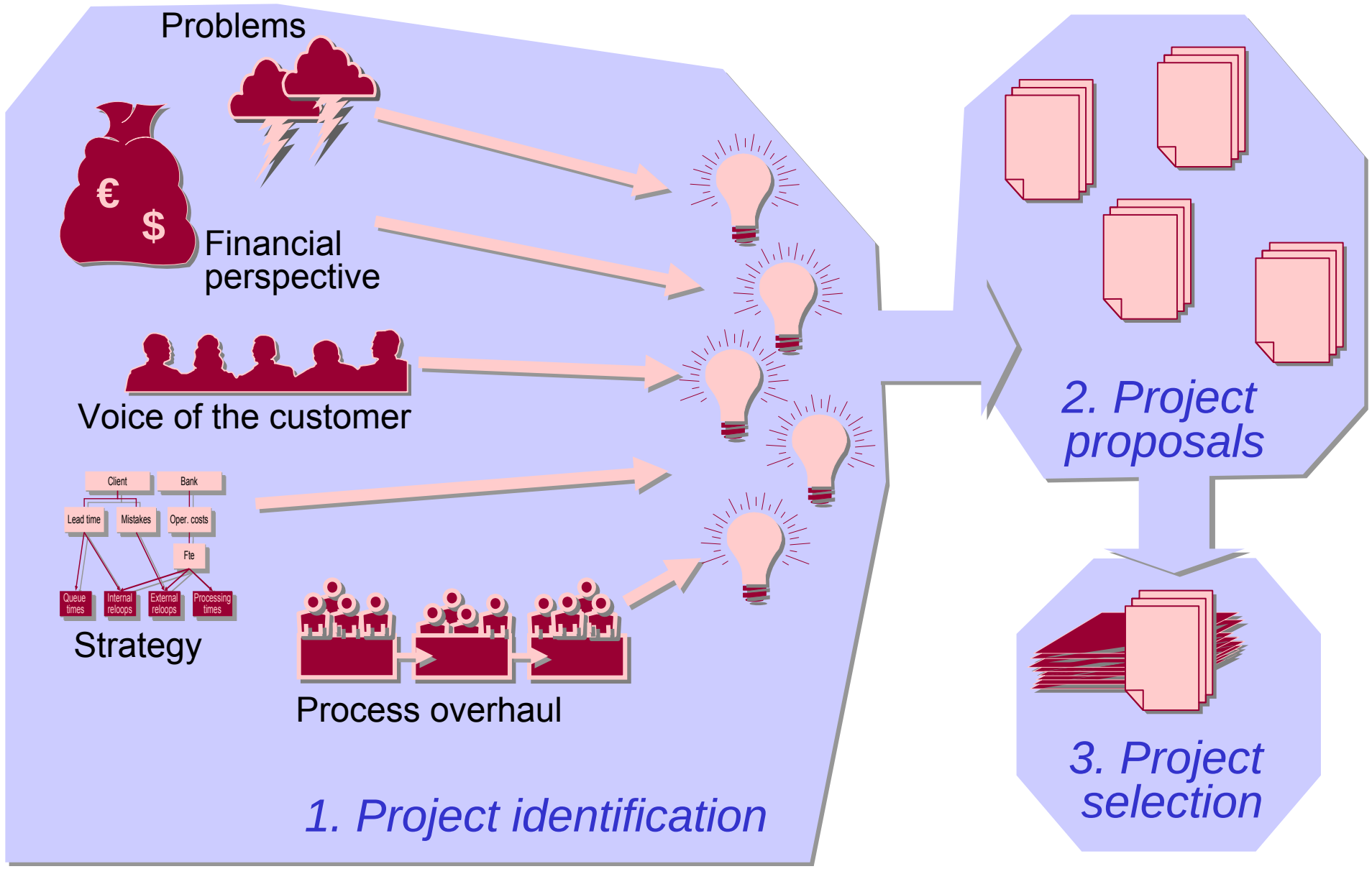
Lean Six Sigma organization



Lean Six Sigma implementation

1. LSS from a strategic perspective
2. The LSS organization
3. ***The project definition process***
4. LSS deployment strategy

Project definition



Lean Six Sigma implementation

1. LSS from a strategic perspective
2. The LSS organization
3. The project definition process
4. ***LSS deployment strategy***

1. Clear vision

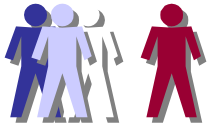
Clear vision
- What do we hope to achieve by implementing a LSS programme? - How does LSS fit in the company's strategy? - What happens if we do not start LSS? - Why now?

Constancy of purpose
Communicate the vision concisely and repeatedly.

Leadership commitment
Management is determined to make LSS into a success.

Example: include a target for Lean Six Sigma in the annual report ("We expect Lean Six Sigma to deliver M€??? by 2008 from the combined impact of revenue growth, cost reduction and efficiency improvement.")

2. Lean Six Sigma organization



Senior business mgt.
(incl. programme director)

Programme managers

MBBs

Set-up the programme management

- Appoint a programme director in the board of directors.
- Appoint one or more programme managers.
- Appoint or hire one or more MBBs.

3. Training

Make a training schedule for GBs and BBs:
- Green belts: 1, 2×3 and 1 days of training.
- Black belts: 2 and 4×3 days of training.

Support	***Reviews***
- Black belts need support from a master black belt. - Green belts can be supported by a black belt. - At minimum: 1 hour per BB per module (4 hours total), and 1 hour per GB per module (3 hours total).	- Feedback during reviews is a vital part of the Six Sigma training. Without reviews, there will be no change in the way of working. - One review (30 minutes) per module (4 for BBs, 3 for GBs).

4. Aligned HR policies

Make clear choices:	*BB / GB certification*
- Give black belts a new job description? - If *yes*: how long will they be BB? What can they expect afterwards? - If *no*: how many hours per week for Six Sigma work? - Promotions tied to Six Sigma engagement? - Performance awards for best GB / BB?	- State guidelines for GB / BB certification, for example: - *Black belts*: 2 (or 3) concluded successful projects, plus an exam. - *Green belts*: 2 concluded successful projects, plus an exam.

5. Integration in ‘all we do’

LSS terminology	*DMAIC procedure*
Use concepts like *CTQ, “Show me the data”, hidden factory, …*	Refer to the 12 DMAIC steps as the logical sequence of steps to take when solving a problem.

Integrate in strategy
Align LSS projects with the business strategy (select projects based on *Key Performance Indicators*).

6. Information technology

Statistical software

BBs and GBs need a software package for statistical analysis. Excel is not enough. Standard LSS package: *Minitab*.

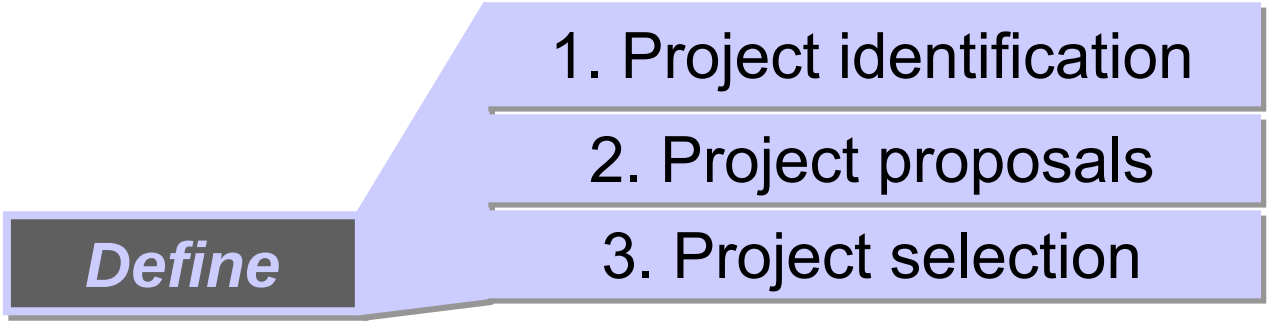
Project database?

- Consider tracking projects in a project database.
- Searchable by theme, process, product, KPI, etc.
- Accessible on intranet?

7. Organize and start the first *wave*

Select projects and BBs / GBs

- Organize the first wave of trainings.
- Select projects. Make sure at least some of the projects have the potential to bring quick wins.
- Select the first wave of BBs and GBs. The first wave has to do the pioneering work, so select bright and motivated candidates.



Summary

Is Lean Six Sigma ***the*** improvement method?

Lean Six Sigma is the culmination of quality improvement principles of the 20th century.

It combines the important principles in a well structured and integrated approach.

It embodies sound scientific theories about methodology, management and economics.

Summary

Is Lean Six Sigma a ***universal*** method?

In the 21st century, being a good craftsman is not good enough anymore.

Professionals need elementary skills in research for decision making and problem solving.

Regardless of the type of business or industry, professionals need the skills that Lean Six Sigma embodies.

After Lean Six Sigma – What's next (1/2)

Is Lean Six Sigma the final method?

Lean Six Sigma is considered a quality improvement program. It is the result of an evolutionary process of previous incarnations of quality management.

Quality as such will continue to be important. But quality management as embodied by Lean Six Sigma need to evolve and metamorphose.

After Lean Six Sigma – What's next (2/2)

Lean Six Sigma's future: Business improvement through innovation

The focus of quality improvement will shift to a business improvement. This shift is fueled by programs like Lean Six Sigma in which quality improvement per se is already replaced by systematic (process) innovation.

Apart from this new trends are incorporated within business improvement programmes (BIPs), such as lean methods. This makes business improvement programmes highly applicable to services.

Literature

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